1997

A comparison of the levels of patient staffing ratios and staffing mix to the number of patient falls in an acute care setting

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A COMPARISON OF THE LEVELS OF PATIENT STAFFING RATIOS AND STAFFING MIX TO THE NUMBER OF PATIENT FALLS IN AN ACUTE CARE SETTING

A Project

Presented to the

Faculty of

California State University,

San Bernardino

In Partial Fulfillment

of the Requirements for the Degree

Master of Science

in

Health Services Administration

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by

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June 1997

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June 1997

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Abstract

The purpose of this study was to determine if there was a relationship between patient falls and the number and mix of staff present. The types of variables looked at included the fall rate, patient census, hours per patient day, numbers of licensed staff and unlicensed staff, the hours of overtime and the hours of staff floated from another unit. The study was conducted over a three year period on two nursing units in an acute care hospital in Southern California. One nursing unit had nursing staff that worked twelve hour shifts. The other unit's staff worked eight hour shifts.

In the one nursing unit, a lower hours per patient day were seen along with higher overtime hours and higher float hours than the other unit. On this unit, the findings suggested that as hours per patient day decreased the fall rate increased. The findings also suggested that there was an increase in patient falls with overtime and float time. As overtime hours increased and as the number of float hours increased, the patient fall rate also appeared to increase. In reviewing the mix of licensed to unlicensed staff, it appeared that the ratio did not contribute to an increase in patient falls.

In the second unit, the hours per patient day were higher, and the overtime hours and float hours were lower. However, in the second unit the mix of licensed to unlicensed staff suggested that a high ratio of licensed staff contributed to a higher rate of falls.

Table of Contents

List of Tables and Graphs

Chapter One - Statement of the Problem

Introduction

Hospitals are facing decreased insurance reimbursements as a phenomenon known as Managed Care becomes more prevalent. Managed care is the attempt to control medical and hospital costs. By decreasing the amount of reimbursement to hospitals, hospitals are forced to cut their costs. Managed care is generally the contracting of a group of health care providers who agree to provide care to a defined population for a fixed amount of reimbursement. (Alred, Arford, Michael, 1995) This payment includes all care delivered regardless of the severity of the patient's illness. This new reimbursement price structure encourages the provider to be very cost efficient in order to stay within the actual cost of the care being delivered and realize some profit to allow the continued operation of the facility. (Guanowsky, 1995) Insurance companies and other Health Maintenance Organizations have become the "gatekeepers" of health care, limiting patient access to hospital admittance until certain criteria are met. Thus, patients are generally sicker when admitted, requiring more interventions, and are discharged earlier than ever before. (Hurt, 1995). As hospitals receive less money, programs are

driven to become more "cost effective" by streamlining services that are deemed "unnecessary". All care deliered is examined for its necessity and may be modified or eliminated altogether in order to preserve costs. Hospitals continue to be challenged to find ways to control costs.(Doerge, Hagenow, 1995)

A major contributor of costs to any hospital is the cost of labor. The labor dollars spent in most health care facilities can be nearly fifty percent.(Sorkin, p.82) Thus, one way a service can become more cost effective is to cut staff members. This impacts patient care as the number of available care givers "at the bedside" become fewer. In addition, the quality, or mix, of staff members has changed. In the past, many facilities had a ratio of 80-100 percent licensed staff, primarily registered nurses. The cost of the professional nurse is more than double that of the non-licensed staff, or nursing aid. Thus, many hospitals have changed that mix to less licensed nurses and more non-licensed personnel, as well as decreased the numbers of staff members per patient.(Feldstein p. 143)

Statement of the Problem

As the number of staff members available to care for the patients continues to decrease, patients may be at an

increased risk of falling. In spite of the challenges of the cost of health care, the hospital has a duty to maintain a satisfactory standard of medical care. (Pozgar, p. 39) To that end, adequate staffing needs to be provided to respond to patients' medical and nursing needs as well as a patient's call for help.(Pozger, p. 38) The increased illness, or acuity, of the patients as well as the decreased length of stay requires the staff to intervene quickly and efficiently with medical care. As patients are sicker when finally admitted to the hospital, and as staff numbers continue to decline, the subsequent increase in workload, i.e., patient care, becomes substantial. Staff becomes overworked with the increased patient load and are unable to adequately supervise the patients. (Way, et al, 1992)

Along with ensuring patient safety, the hospital shares in the responsibility for employee safety. (Pozgar, p.41). Physical injury as well as "career" injury may be seen to be one and the same. In other words, placing employees in what can appear to be inadequate staffing ratios that place the patient at risk may also be perceived as putting the employee at legal risk.(Grant, 1993)

Saving the cost of employees by reducing staff and changing staffing mix may cause an increased cost to hospitals through liability issues. Up to 84 percent of adverse events that occur in health care agencies, including

hospitals, are related to patient falls. It is estimated that an overall increase in the nationwide cost of health care can be as high as two billion dollars annually, and this figure is climbing. Each year over nine thousand persons over the age of sixty five die from falls or from the chain of events that occur after the fall.(Hendrich, 1988) Additionally, a fall can cause older persons to greatly change their lifestyles, as they may "live in fear" of falling and seek to avoid another incident through restructuring their lives, often to the point of becoming homebound (Lawrence, Maher ,1988)

The purpose of this study is to evaluate the point at which patient falls will occur because the number of staff available is insufficient. In addition, the mix of staffing will be looked at to determine if the decreasing numbers of licensed staff has contributed to an increase in patient falls.

Questions

The objective of this study is to determine if there is a relationship between the levels of staff members and staff mix to patient falls. There are three specific questions to be addressed by this research. 1. Is there a relationship in the number of patient falls and the available staff

assigned to care for the patients? 2. Is there a relationship in the number of patient falls and mix of the staff assigned to care for the patients? 3. Is there a point at which there is an increased risk that a patient will fall in relation to staffing numbers or mix?

Significance of Study

Patient falls result in increased mortality and morbidity, especially in the elderly. Nearly 75 percent of all falls occur in the older population. One of the most frequent of all serious fall injuries sustained by the elderly are fractured hips. There is nearly a 50 percent mortality within the year of hip fractures. (Hendrich, 1988) Falls and complication from falls increase health care costs through unplanned interventions, including surgery, and can significantly increase the length of stay in the hospital. (Cohen, Guin, 1991) Falls account for 70-80 percent of all hospital incidents. (Lawrence, Maher, 1992) As the population continues to grow older there is a need to develop ongoing programs and care protocols of the older adult to reduce the risk of fall and injury. (Hendrich, 1995) It is important that part of those protocols include adequate staffing ratios to ensure the programs aimed at fall prevention are enacted.

This study was done based on the assumption that the presence of nursing staff, or patient care givers, work in a similar fashion in each unit that was studied. For example, having six staff members assigned to an area does not mean they would be present for the entire shift. Lunch and other break times, along with errands for medications and equipment might additionally pull a staff member away from the unit. These are normal activities that are assumed to have changed very little over the time this study was conducted.

Although there is research that indicates that not all patient falls are reported, for the purpose of this study, it is assumed that the numbers and kinds of falls reported did not change over the study period. Finally, even though the facility did not have a formal fall prevention program, it is assumed that the presence of such a program would not necessarily change the outcome of the study. The assumption being that a falls program needs personnel to ensure the program is conducted properly, and this requires the presence of staff. As staffing cutbacks have occurred, any fall program that might have been in place could show an increase in the number of falls with a decrease in the numbers and mix of staff.

Scope of Study

This is a retrospective study conducted over a three year period, from January 1, 1993 through December 31,1995, in a 403 bed medical center. The patient population in the area was relatively unchanged through the study except for a declining census related to shorter length of stays. Patient fall data were adjusted to compensate for any census change. Data collected for the study included the number of patient falls by date, the number (hours) of staff working each day, and the mix, that is type of nursing staff working each day.

Chapter Two - Review of the Literature

Introduction

Since the 1970's, efforts have been made to limit the amount of dollars spent on health care. Health Maintenance Organizations (HMO), such as Kaiser Permanente, gained prominent recognition for cost control in the 1960's by providing a wide range of health services along with insurance coverage. It was already being recognized that cost control, through limited length of hospital stay along with efficient care, was attainable. (Steinwachs, 1992) As a result, the Health Maintenance Act of 1973 was enacted with the express purpose of further development of HMO type groups. However, dramatic rises in the cost of health care continued through the mid 1980's. It was recognized that the increase in the cost of health care was occurring because of the growing population and the nature and quality of health services being consumed. (Williams, Torrens 1984)

In 1974, the National Health Planning and Resource Development Act established a system of health agencies created to control the cost of health care. (Fawley, 1992) In spite of these efforts, by 1975, 8.6 percent of the Gross National Product (GNP) was being spent on health care. The Social Security Act of 1983 implemented the Diagnostic

Related Group (DRG) reimbursement plan. Under this system, patients were grouped by discharge diagnosis, and hospitals were paid on a per case basis. (Williams, Torrens, 1984)

Although the DRG strategy demonstrated initial cost savings, by the late 1980's hospital costs had returned to a 10 percent annual increase. In 1990, health care costs accounted for nearly 12.4 percent of the GNP. At that rate, it was estimated that by the year 2000 health care would consume nearly 20 percent of the GNP. (Tharpe, 1992) Even without specific mandates from the government for health care reform, the efforts of the purchasers of health care to contain costs met with the equally responsive providers of health care to meet that demand has heralded in Managed Care (Guanowsky, 1995) Cost Control is the major component of most health care reform proposals, and Managed Care is no exception. (Heinen, Chase, 1994)

The basic premise of managed care is to provide health care while exerting controls on efficiency, cost and access. Managed care organizations include HMO groups, insurance companies, hospitals, and physicians.(Guanowski, 1995) Patient care management is done through an agreement of these network providers who agree to provide health care to a defined population for a set price. This price does not take into account how ill the patient may be or how much health care the patient may require. The capitation aspect

encourages health care providers to compete on the basis of dollars and quality for care delivered. (Alred, Arford, Michel, 1995) Hospitals have been increasingly forced to deal with the two issues of cost and quality. Yet, the relationship between these are as equivocal as they are complex. (Flemming, Boles, 1994)

In addition to cost controls, health care reform, i.e. managed care has shifted the economic risk of the third party payors (insurance companies) to the hospital providers of health care. (Manheim, Feinglass, 1994) With the continuing decrease in reimbursement for care rendered, the increasing financial risk of caring for patients and the sicker more "costly" patients being admitted to the hospital, hospitals have little choice but to streamline their services to control costs. Cutting the labor part of the budget is an easy way to make a large financial impact, as labor costs can be nearly a majority of a hospital's budget. (Feldstein p. 143) This response, however, places the patient at risk for injury. Hospitals today are treating a significantly more ill patient in need of more intensive treatment than ever before and during a shorter period of time. (Manheim, Feinglass, 1994) In addition, the elderly population is expected to double in numbers by the year 2030. (Hendrich, Nyhuis, Kippenbrock, Soja, 1995) Hospitals with a high proportion of elderly patients can

expect to have a higher rate of falls. (Goodwin, 1993) When a minor injury to an elderly person can lead to institutional care, the financial and liability risk to a hospital is enormous. (Healey, 1994)

There are few adverse events that occur in hospitals today that can have more serious consequences to patient outcome and quality of life as a patient fall. (Hendrich, Nyhuis, Kippenbrock, Soja, 1995) Falls have been identified as the second leading cause of death in the United States, with 75 percent occurring in the elderly population. In an acute care setting 20 to 30 percent of patients who fall sustain injury. (Maciorowski, et al, 1988) Patient falls are also one of the most common reasons that hospitals and nursing staffs are sued. (Hendrich, Nyhuis, Kippenbrock, Soja, 1995) A patient who ends up confined to bed as a result of a fall can experience many problems associated with immobility including mental impairment, skin breakdown, loss of muscle tone and demineralization of bones. These factors alone can set up a patient for further traumatic injuries. (Maciorowski, et al, 1988)

Increased patient acuity levels and decreased staffing can make the task of preventing patient injuries nearly impossible. (Hendrich, 1988) It is then important to evaluate patient falls, in the acute care setting, in relationship to the patient staff ratios and mix of

staffing, for several reasons. First, there is an absence of standards that determine minimal staffing requirements. Neither federal regulations nor the Joint Commission of Accreditation of Healthcare Organization (JCAHO) have specified minimally acceptable patient staff ratios. (Way, et al,) In some states, such as California, mandatory licensed staff ratios exist for critical care units only. (Barclays, 1996). Consequently, the continued increase in the number of patients per nurse could have deleterious effects in relation to patient falls.

Secondly, Nurse researchers have long recognized that the complexities of patient falls and the prevention of those falls are related to the numbers of staff available. It has been noted that there is an increase in patient falls in units were there is a shortage of staff. (Morse, 1988). It would be helpful for a manager or administrator of a patient care unit to know the point at which too few nurses would increase the risk for a patient fall. The hospital is responsible for the safety and well being of not only the patient but the staff as well. A patient fall puts both the hospital and the nursing staff at legal risk. (Ruckstuhl, Marchironda, Salmons, Larrabee, 1991)

A third reason to evaluate patients falls and staffing ratios is that the costs associated with patient falls can be staggering. Falls among the elderly population can

account for substantial morbidity and mortality (Robbins, et al, 1989). A patient fall can increase length of stay and increase costs associated with secondary complications and other interventions required to treat an injury. In today's reimbursement climate, the cost of a patient fall is absorbed by the institution. (Innes, 1985). Additional costs to the institution may include adverse perception of the hospital by the patient, family, and associates. (Ruckstuhl, et al 1991). Recovery from a hip fracture can block an acute bed for up to several weeks and cost over $20,000.(Healy, 1994). St. Paul Fire and Marine Insurance, which insures hospitals nationwide, reviewed their institutional claims and determined that the average cost of a patient fall for acute care hospitals ranges from $7,500 to $8,500 per fall.(Bed-check, 1987).

There is a cost in both achieving and maintaining quality. There is also a cost as a result of not achieving and maintaining quality. Quality standards are an expectation whether expressed from external forces i.e. JCAHO, or Insurance companies or internal expectations e.g. care is delivered in a timely manner. (Waress, Pasternak, Smith, 1994) The final reason to study patient care ratios to patient falls is that there are no current studies address the effects of the managed care environment in relationship to the ongoing decrease of the number of

bedside nurses, the mix of staffing, and the rate of patient falls. (Tutuarima, deHaan, Limburg, 1992)

Specific Studies on Patient Falls

Fall Research has become a focus since the late 1970's. Researchers have used epidemiological techniques i.e. gender, age, diagnosis, etc. to focus on the seriousness of the problem. Multi disciplinary approaches have also been used. For example the physician may treat the underlying cause of a fall, such as low blood pressure, or dizziness, while the physical therapist may treat weakness in the legs with gait training and strengthening exercises. Nursing research has used a comprehensive approach of physical, psychological, social and environmental factors in designing fall prevention strategies. (Morse, p. 302) In fact, many studies of patient falls have been conducted with the objective of identifying patients who are at risk for falling and determining which interventions would decrease the fall rate. Although there is no standard definition of a patient fall, the majority of the research reviewed agreed with Lawrence and Maher's (1992) definition of a patient fall as an unplanned slip to the floor either with or without an injury.

Ellen Barbieri,(1983), noted that patient falls were

rarely a chance occurrence. They are, instead, a complex phenomenon that occurs because of multiple and often unrelated factors regarding the patient's condition that compromise the patient's safety. The three part study conducted at the San Diego Veterans Administration Medical Center in 1980 was to identify the demographics of patient falls. Several factors were discovered. The highest incidence of falls (45%) occurred between the hours of 6:00 a.m. and 10:00 a.m. and between 4:00 p.m. and 8:00 p.m. and were related to bathroom activities. Recommendations included reassessing staffing patterns during those hours, specifically in relation to the number of patients on the unit who were at risk for falling.

In an earlier study, Lund and Shaefor (1988) reviewed nearly 2,000 admission records during 1978 to determine which patients fell and why they were at risk for falling. Their study also noted that staffing practices and fall rates were related. During a three month period, patient falls were higher in a unit that had primarily a new R.N. graduate staff with many other staff in orientation. Six months later the same unit noted a more stable staff with very few orientees and a much lower fall rate.

In 1985, Morgan, et al, published a study looking at twenty two months of retrospective data from 1981-1982 Their findings demonstrated that 65 percent of patient falls

occurred in the patient's room, either by the bed or on the way to or from the bathroom. It is of interest to note that at that time, the trend toward private rooms and the subsequent decrease in the ability of the staff (and fellow patients) to observe the patient, was thought to account for the increase of patient falls. Morgan also noted that the risk of falling in patients over the age of sixty five was considerably greater than for those under the age of sixty five.

Janken, Reynolds, Swiech (1986) showed again that there were proportionately more patient falls in private rooms (60 percent). Janken also identified twelve variables that could be used as predictors of patient fall risk. The top three were general weakness and upper and lower extremity weakness. Jenkins goes on to describe that patients who were in an overall poorer state of health were more likely to fall than those who were not. The study also concluded that nurses were key in identifying patients who were at risk for falling. Unfortunately, the study did not go into any further detail regarding the affect nurses could have in fall prevention.

W. J. Falbe, (cited in Lawrence, Maher, 1992) showed that one out of every five patients may fall sometime during their stay in a hospital and 20 to 30 percent may sustain injuries. Their study concluded that despite significant

frailty and debility in some patients, and the use of side rails, non-ambulatory patients climbed out of bed and fell. They were also more likely to sustain injuries than other patients. Other studies, such as Tinetti, et al,(1993), determined that the occurrence of falls was proportionate to the number of risk factors in the elderly patient. Clearly, the sicker the patient the higher the risk for falling.

As research has progressed on the causality of patient falls, fall prevention programs have followed. Though the first programs were very basic, patient falls were reduced. A study conducted by the Nursing Service Quality Assurance Committee at a mid-western hospital, (Hill, Johnson, Garrett, 1988), found it was a priority of the nursing staff to determine interventions to prevent patient falls. The following indicators were chosen: dizziness, partial paralysis, confusion, impaired judgement and multiple medications. They based the indicators on 1986 hospital fall incident reports related to age and length of stay in the hospital. Their study showed that an increase in falls occurred for patients over the age of 60, especially in patients hospitalized for more than fourteen days. A computer program was developed to look at the total numbers of falls per unit and related them as a percentage. Based on their findings, the fall prevention program consisted of assessing patients for fall risks and documenting them in

the chart. The specific patient interventions were rather vague in the study, limited mostly to increasing communication to the nurse, with the exception of education. The nursing staff conducted extensive individual patient education sessions to increase the patient's awareness to the specific factors that could cause a fall, and to teach preventive measures. Both staff and patient education was believed to be the two strategies that showed a reduction in the number of patient falls. However, the time required to implement such a program and the personnel required was not discussed.

Ann Hendrich (1988) evaluated the use of a High Risk Fall Prevention tool developed by the nursing staff at Methodist Hospital of Indiana. There, researchers reviewed literature and compared it to their own fall data to determine fall risk factors. Patient interventions included identifying the patient at risk for falling with a colored bracelet and placement of color "dots" over the bed to alert the staff. Other interventions included placing the patient close to the nursing stations, making frequent rounds to "check" on the patient, use of appropriate footwear and, most importantly, constant supervision of the patient while out of bed. Patient and family education was emphasized. A 50 percent decrease in the number of falls was seen, when compared to their previous year. Hendrich was concerned

that using percent of falls as an indicator would give inaccurate information and could not be compared to other facilities. Hendrich also noted that inadequate staff and increased patient acuity levels made the increased observation of patients nearly an impossible task.

The inability to determine the actual incident of falls has been identified in the literature has made it difficult to determine both an acceptable fall rate and a rate of improvement. (Cohen, Guin, 1991) Morse (1988), recommended a standard fall rate calculation determined by the number of falls divided by the number of patient days multiplied by 1,000. This figure would be comparable between hospitals and not effected by the rising and falling of census. Cohen's study noted their hospital fall rate had been 3.8 falls per 1,000 patient days but had climbed to nearly 10 patient falls per 1,000 patient days.

After an extensive literature review, Cohen and researchers implemented fall prevention strategies that included hourly rounds on all patients, even those who were cognitively intact. Patients were given opportunities for ambulating, but only under strict supervision. Multiple educational in-services were given to the staff. During the study the patient workload and staffing ratios were monitored, but unfortunately the researchers did not compare fall rates with the level of staffing. The researchers

concluded that through the implementation of their fall prevention strategies, the fall rate decreased to a satisfactory 3.8 fall per 1,000 patient days. However, enormous effort on education and staff participation was required.

In 1991, Kilpack, Boehm, Smith, and Mudge evaluated their researched based fall prevention program to determine its effectiveness in preventing falls. Unfortunately they limited their review to patients who had already fallen to see if their strategies prevented a repeat fall. A Clinical Nurse Specialist (CNS) completed a descriptive data sheet on all patients who had fallen and determined an individualized plan of care to prevent a repeat fall. To lower the fall rate in the repeat fallers category, an extensive educational program was instituted, including quarterly in-service programs.

Applying these interventions after the fall did reduce the rate, but this seems to be a flawed approach. Of note, however, is the approach used with staff to maintain diligence in fall preventive activities. A CNS was assigned to follow up daily on the high risk patients and visual reminders were give to the staff, including cue cards and posters. Case study presentation and frequent educational strategies, including daily reminders by the CNS, completed the program. This kind of constant surveillance of high

risk patients had to have an enormous cost, but the study failed to evaluate that component. Additionally, the study did not look at the number of staff members required to carry out all of this activity. Even with all of this attention, the study noted that the nursing staff were able to accomplish the fall prevention strategies only about 90 percent of the time.(Kilpack, Boehm, Smith, Mudge, 1991).

Hendrich, Nyhuis, Kippenbrock and Soja (1995), using 22 different risk factors, determined that the majority of falls (over 75%) occurred in the patient's room while the patient was alone, and nearly 50 percent were related to elimination needs. This study's objective was to develop a tool to assess fall risk factors in patients. Known as the High Risk Fall Model (HRFM), it's purpose was to attach point values to seven known fall risks: confusion or disorientation, depression, altered elimination, recent history of falling, mobility weakness, dizziness, and primary cancer diagnosis. These risks were then weighted according to severity. After assessing the patient and adding the score, different levels of interventions were implemented by the nursing staff. The study affirmed the need for frequent reassessment throughout the patient's stay in the hospital. The evaluation of the tool was not addressed in this study.

At the conclusion of the study, however, Hendrich et

al, expressed that hospitalization itself poses a major risk for the older person and that the traditional interventions of immobilizing and restraining the patient to prevent a fall were most likely contributing to the numbers of falls. They suggested that programs aimed at increasing the patient's mobility might have greater improvement on the fall rate. These researchers also added that additional investigation should be done to evaluate the routines on the unit to determine when nursing staff would be away from the patient care areas (such as breaks or report time). The investigators felt that alternative personnel should be made available during those times to assist the patients. It is evident by this study that the presence of nursing staff can decrease the risk of patient falls.

Research within the last ten years, in regards to evaluating the number of staff and patient falls, is limited to one study conducted in the Netherlands (Tutuarima, deHaan, Limburg, 1992). Nine Dutch hospitals evaluated the impact of nursing workload on stroke-patient falls. They used a convenience sample of 390 patients from the nine hospitals that were part of a 760 stroke patient, 23 facility study on quality care. Patient data were collected from medical records, and ward (not defined) characteristics were provided by the managers. Variables included the total number of patients, the number of stroke related patients

versus non-stroke patients, the acuity (intensity of patient care required in relation to illness) and the number and composition of the nursing staff. A high acuity patient was defined as a patient who had to be monitored one or more times per hour. Control patients were matched using the same variables. The differences between the mean patient per nurse ratios were calculated with a 95 percent confidence level. Of the 349 patients, 49 fell (14%). The researchers found no overall difference between the nursing workloads of the case and control group patients and inferred that the number of nursing staff was not a major contributing factor to the occurrence of falls. The average nurse to patient ratio was 7.4. Shift comparisons showed the day shift had 3.46 patients per staff member, the evenings had 7.44 patients per staff member, and there were 11.38 patients per staff member on the night shift.

In further review of this study, several discrepancies are apparent. First, it is unclear from the study what time frame Tutuarima, et al, used. Was this a "snapshot" look at patient falls, that is done only at the time of the fall, versus looking at it over a determined time? Secondly, there is no breakdown of the composition of the staff that is given in the study although it was mentioned as one of the variables. Thirdly, it was noted in the study that six of the thirteen wards expressed a shortage of staff.

However, in three instances the problem was solved by stopping patient admissions to the ward. Thus, these wards were really not short staffed. In another six wards there were a shortage of staff only on specific shifts. On those specific shifts, however, the researchers reported that five cases (10%) experienced a patient fall. This fact did not seem to be taken into account in their analysis. Since most of the areas had appropriate staffing, it was not valid to conclude that the staff to patient ratio had no effect on patient falls. Finally, this study only looked at the stroke patients on the floor and did not take into consideration the other types of patients or if those patients experienced falls.

Further study of the relationship between numbers of nursing staff present compared to patient falls is needed to determine the impact fewer staff may have on patient falls. Data should be evaluated over time in relation to falls, both for changing patient staff ratios and changes in staffing mix.

Null Hypothesis

There is no relationship between the numbers of patient falls and the available staff assigned to care for the patients.

There is no relationship in the number of patient falls and the mix of staff assigned to care for the patient.

There is a point at which further reductions in staff will not increase the risk of patient falls.

Chapter Three - Methodology

General Methods

This was a retrospective study that reviewed patient fall data over a three year period of time and compared nursing staffing data for the same time period. The factors looked at were the relationship between the numbers of patient falls and the numbers and mix of assigned staff.

Specific Procedures

A letter to the Chief Executive Officer defining the intentions of the study was sent. Both the Chief Operations Officer and the Chief Nurse Executive were informed. Permission to conduct the study was granted.

Research Population and Sample

The population studied were patients who had a record of a fall and who were admitted to a Southern California Hospital, between the dates of January 1, 1993 through December 31, 1995. The fall population was further defined as having had the fall while admitted to one of two medical/surgical units in the hospital: Four Tower West or Five North Tower. A patient fall was defined as an unplanned slip to the floor, either with or without an

injury. The fall data used included patients who were found on the floor even if it was unknown if the patient actually fell. Fall data did not include patients where staff members had lowered the patient to the floor for various reasons, such as the patient becoming faint or weak.

Fall data was obtained from the Quality Services Department computer data base at the same hospital. Fall information was gathered through the hospital's Variance Report system. This system was a written report of events that occurred to patients that were unexpected or out of the normal procedure. A patient fall was considered to be an event reported in this fashion. The nurse on the unit was responsible for completing the Variance Report when a fall occurred and sending the report to the Quality Services Department. Information from the Variance report was entered into a computer data base by medical record number, date, time, nursing unit the fall occurred in, the fall description and outcome. Fall information for this study included the fall, the date of the fall, and the unit the fall occurred. Because of a change over in computer systems at the hospital, computer based patient fall information was only available from December 1, 1993 through December 31, 1995. Patient fall information from January 1, 1993 through November 30, 1993 was obtained by reviewing the stored variance reports in the Medical Records Departments. Since

these records contain the same information that was in the computer data base, it was felt that this information was acceptable for the study. Staffing of the nursing units was based on the census for each shift.

The medical/surgical units used offered different characteristics. Four Tower West was a 36 bed unit which served predominately surgical patients, however medical patient overflow was common. Five North Tower was a 32 bed unit which served predominately medical patients. Surgical patient overflow was common. Patient staffing ratios were believed to be similar in size and mix. The staff on Four Tower West worked 12 hour shifts and the Five North Tower staff worked 8 hour shifts. Staff from both of the areas floated from one to the other unit as needed.

Staffing data was obtained from the ANSOS (Automated Nurse Scheduling Operations Systems) data base. Staffing data included productive time for each unit. Productive time, also known as productive hours, represented hours worked on the unit that related to patient care. These hours did not include the nursing manager or any other support personnel, such as a clinical instructor. Also these hours did not include any vacation or sick time.

The productive hours were further delineated into licensed and non-licensed staff. Licensed Staff included the registered nurse (RN), and the licensed vocational nurse

(LVN). Unlicensed staff was comprised of the nurse aid (NA) and the ward clerk, or secretary, (WC). Licensed staff primarily had oversight of the patient care and spent most of the shift assessing the patients, correlating results of diagnostic studies, contacting the physicians for direction, planning interventions and implementing care. Many of the actual direct patient care activities were delegated to the unlicensed staff. The unlicensed care giver's role was mostly task oriented. These tasks included bathing and feeding the patients, answering call lights and running patient related errands.

Other staffing data included overtime for each unit and float hours. Overtime was defined as hours worked over the regular schedule of the employee. In the twelve hour shift unit, Four Tower West, overtime was not calculated until the employee worked past twelve hours in a day or thirty six hours in a week. In the eight hour shift unit, Five North Tower, overtime was calculated after the employee had worked over eight hours in a day or over forty hours in a week. A week, for the purposes of this study, was considered from 12:00 a.m. Sunday to 11:59 p.m. the following Saturday.

Float hours were also tracked through the ANSOS system Each time an employee worked in a unit different than the one in which they were hired to work, the information was recorded as float hours. Staff from the twelve hour shift

unit who floated to the eight hour unit did not have overtime counted until after twelve hours.

The amount of staff provided and the ratio of licensed and non-licensed staff was determined through the annual budget process done each fiscal year (July). The determined hours allotted for staff per patient provided the target range for staffing each unit. Any budget changes in the numbers of staff and the mix of staffing (i.e. RN, LVN, NA, WC)were reflected in new staffing matrix. This matrix sets up the numbers and mix of staff allowed for a given census.

Staffing on the unit for patient care was evaluated at least three times each twenty four hours and adjusted, based on the census of the units. Prior to July, 1995, staffing for both units was based on patient census only. After July, 1995, staffing was adjusted for the acuity, or the degree of illness of the patient. Because of the unavailability of acuity information, it was not part of this study.

Staffing of the nursing units was based on the census for each shift. Unit census data, for the purpose of this study, were taken from the midnight census. Midnight census data reflected the number of patients occupying a patient bed at midnight each twenty-four hours. The twenty four hour period used in this study was from 12:00 a.m. to 11:59(and 59 seconds)p.m. The number of patients was counted just

prior to 11:59 p.m. This census does not reflect the numbers of admissions or discharges to the unit that may have occurred during that twenty four hour period. Midnight census data also does not represent the degree of illness a patient may present with during the hospital admission, known as acuity.

Midnight census data was obtained from the hospital data base. Similar to the fall data, this computer data base contained daily census from December 1, 1993 through December 31 1995. Census data from Jan 1, 1993 to November 30, 1993 was obtained from stored paper records. All census data was listed by date for each twenty four hour period, from January 1 1993 though December 31, 1995.

Method

A spreadsheet program (Quattro Pro version 6.0) was used for the compilation of the data. Data from the various data bases(i.e., Fall, Staffing, Census), was entered into a spreadsheet program. Data was listed by date from January 1, 1993 through December 31, 1995. The spreadsheet headings included the following data: Date (DATE), Patient census (DAYS), Patient Falls (FALLS) Productive time for the Nursing Assistant (NAPROD),the Licensed Vocational Nurse (LVNPROD), the RN(RNPROD), and Ward Clerk (WCPROD),

Overtime (OVERTIME) and floating hours (SUPP). This data was listed for each unit (FLOOR) and was noted by a 4 (4.00) or 5 (5.00). (See Appendix A)

Once the data was entered into the spreadsheet program several calculations were performed on the data. The decision was made to combine licensed positions (RN and LVN) into one set of numbers. The actual hours for the LVN were very low and their functions, at the time of this study, were similar to the RN in the care of the patient. Total RN productive hours (RNPROD) were added to LVN productive hours (LVNPROD) by date. This new total, noted as total licensed (TOTLIC) on the data collection sheet, was the number used in the study.

The unlicensed position hours, NA and WC were also combined into one total. This decision was made because the majority of these positions were cross trained to do both ward clerk and nursing assistant duties. The WC hours (WCPROD) were added to the NA hours (NAPROD) by date to create the total unlicensed hours (TOTUNLIC) and this number was used in the study. Total productive hours was the sum of the total licensed and total unlicensed hours to create total productive hours (TOTPROD).

Hours per patient day (HPPD) was a measurement of productivity that reflected the amount of staff assigned on the unit on any given day. HPPD is determined by taking the

total productive hours (TOTPROD) and dividing by the patient census (DAYS).

The amount of data used in this study was quite large. 1095 days of information for each unit was reviewed. In order to accomplish an initial overview of the data it was separated into six month blocks of time. Numerical data for the following categories was reviewed: Fall Rate, HPPD, OT (overtime), SUPP, Licensed and Unlicensed, and Patient Days. (See Appendix B)

The fall rate was a calculation used to factor out the daily changes in the census. The number was achieved by taking the number of patient falls and dividing by the number of patient days. This number is then multiplied by 1000 to make it easier to work with. For the broad overview, the total number of fall for each six months was divided by the total number of days for the same six months, and then multiplied by 1000.

The remaining categories of data that were viewed in six month blocks of time were averages of the total numbers for each section. Hours per patient day (HPPD) was the sum of six months of data (January 1 to June 30 1993, for example) divided by 182.5 days(six months). Overtime (OT) was the sum of hours for six months divided by 182.5. Float hours (SUPP) were the total hours for each six months divided by 182.5. Licensed hours were the total hours

divided by 182.5, and unlicensed hours were the total hours for each six months divided by 182.5. The purpose of this process was to be able to view the large quantity of data more easily. There were no conclusions drawn from this process.

Once the all of the various data was entered into the spreadsheet program it was loaded into SPSS (Statistical Package for the Social Sciences) for Windows. Non parametric statistics were used since random selection did not occur in the data, and the variables used were considered to meet the criteria of being ordinal data. Because non-parametric data do not meet strict statistical criteria substantial differences in the scores were sought for this study. Significance at the .05 level or less were considered meaningful.

Chapter Four - Findings

Introduction

The purpose of this investigation was to determine if there was any relationship between the number of patient falls and the available staff assigned to care for the patient. It was believed that the study would demonstrate that either the number of staff, or the mix of staff assigned related to the number of patient falls and that one could determine a point at which further reductions in staff would increase the risk of patient falls. The results of this study are included in this chapter.

Demographics of the Nursing Units

Two medical-surgical units were used from the same medical center that participated in the study. Each unit offered different characteristics, such as types of patients and scheduled staff, as well as similar characteristic such as size and cross training of staff to both areas. Four Tower West was a 36 bed unit that admitted predominately surgical patients, including orthopedic and neuro surgical patients. Overflow of medical or non-surgical patients was common. The nursing staff was cross trained to care for medical patients. The nursing staff, (RN, LVN, Ward Clerk,

and Nursing Assistant) on Four Tower West worked twelve hour shifts. During the study, the day shift hours were from 6:45 a.m. to 7:15 p.m. The night shift hours were from 6:45 p.m. to 7:15 a.m. This provided a half hour of "overlap" coverage for patient report to be given to the oncoming shift. The Ward Clerk staff worked eight hour shifts, and those shifts were from 6:45 a.m. to 3:15 p.m., 2:45 p.m. to 11:15 p.m. and 10:45 p.m. to 7:15 a.m.

The second Nursing Unit was Five North Tower. This unit had 32 beds that admitted primarily non-surgical patients such as Oncology, Diabetes and Renal Failure. The nursing staff was cross trained to care for surgical patients that were admitted when the other unit was filled. All of the staff worked eight hour shifts, as described for the Ward Clerks on Four Tower West.

In January 1994, another medical-surgical unit was combined with both Four Tower West and Five North Tower. This third unit admitted the same mix of patients, but due to dropping census in all of the units an administrative decision was made to combine the third unit with the units of this study and close the third unit. Surgical type patients from the third unit were then admitted to Four Tower West, and medical type patients were admitted to Five North Tower. Staffing was adjusted to accommodate the new increased census. Staff from the third unit were transferred

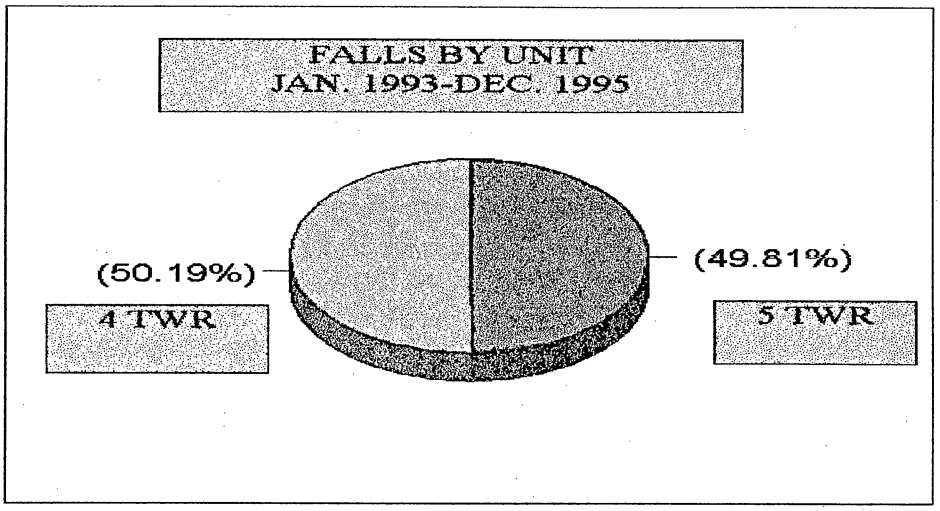
to the unit of their choice. The process of transferring the staff and providing the necessary training was completed by the end of February, 1994.

Research Population and Sample

Patients who were admitted to a Southern California Hospital between the dates of January 1, 1993 and December 31, 1995 and who had a record of a fall occurring on either Four Tower West or Five North Tower were included in the study. A patient fall was defined an unplanned slip to the floor, either with or without injury. Each day was part of the study whether or not there was a patient fall. The total number of days examined were 1095 in both units. The data about a patient fall was gathered from the hospital's Quality Service data base which records all falls that are reported by the Variance Reporting system.

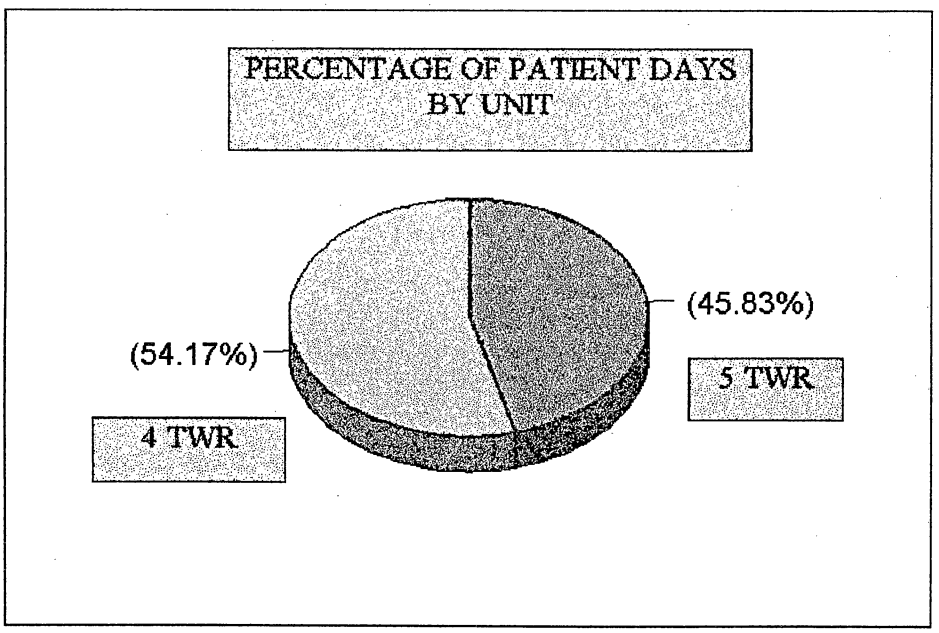
Patient Days and Falls By Unit

Four Tower West had a mean number of patient days, or census, of 25.54. More than 54 percent of the total number of patient days looked at in this study was on Four Tower West. Five North Tower had a mean number of patient days of 21.61 and had nearly 46 percent of the total number of census used in the study.(See Graph 1)



Graph I Patient Days By Unit from January 1993 through December 1995.

The number of patient falls were nearly equal between the units: 49.8 percent on Five North Tower and 50.2 percent on Four Tower West. (See Graph 2)



Graph 2. Falls By Unit from January 1993 through December 1995.

Hours Per Patient Day by Unit

Staffing data was obtained from the ANSOS (Automated Nurse Scheduling Organizational System). Staffing data consisted of hours worked by each nursing staff members assigned to patient care on either Four Tower West or Five North Tower. This study included the hours of employees who may not have been hired directly for the two units in the study but worked at some point during the study in either of the two units. All of the nursing staff working in the Medical Center during the study were entered into the ANSOS data base. Each staff member had a separate identification number, and hours worked by each employee were entered into the ANSOS data base. These hours included regular hours and any overtime hours. Additionally, if the staff member hired for a different unit other than the units in this study but worked time during the study for either Four Tower West or Five North Tower, their hours were counted as productive time and also identified as floating hours. Staff hired to work on Four Tower West who were floated to Five North Tower were logged in the data base as having floated and vise versa.

Hours per patient day (HPPD) is a measurement of productivity that demonstrates the amount of staffing on a given unit for a twenty four hour day. HPPD was determined

by adding the productive hours of all employees who work in a twenty four hour period divided by the census of the unit at midnight. Productive time, or hours, consisted of regular hours worked and any overtime hours worked. For this study, HPPD were first examined in six month blocks of time. This look at the broad data was used to determine if there were any changes that might correlate with patient falls.

In reviewing the HPPD, it was noted that the hours varied between the units and between each six month block of time. In each six month block of time, from January 1993 through December 1995 on Four Tower West, the HPPD were as follows: 6.15, 5.97, 5.89,5.81, 6.30, 6.78. On Five North Tower the HPPD were: 6.73, 6.49, 6.59, 6.09, 6.49, 7.10. (See Table 1)

Table 1: HPPD for Four Tower West and Five North Tower for periods January 1993 though December 1995.

YEAR	HPPD Four Tower West	YEAR	HPPD Five North Tower
Jan-June 1993	6.15	Jan-June 1993	6.73
July-Dec 1993	5.97	July-Dec 1993	6.49
Jan-June 1994	5.89	Jan-June 1994	6.59
July-Dec 1994	5.81	July-Dec 1994	6.09
Jan-June 1995	6.30	Jan-June 1995	6.49
July-Dec 1995	6.78	July-Dec 1995	7.10

Fall Rate

A standard fall rate calculation was used to ensure that data was treated consistently. Since floor census change each day and an increase or decrease in the total number of patients each month occurs, one could assume that the number of falls was related to only census changes and not other factors. A formula was used to factor out the fluctuations of the census. The formula used the number of patient falls in a given period divided by the number of patient days in the same period and multiplied by 1000. This is referred to in this study as the fall rate. An evaluation of the data was done on the gross data level.(see table 2) On Four Tower West, during January to June 1993, the fall rate was at 2.09. From July to December 1993, the fall rate had increased to 4.67. During January to June 1994, the fall rate had increased to 6.08 and increased further to 7.68 during the later half of the calendar year. For the period of January to June 1995, however, it was noted that the fall rate decreased to 4.99 and continued to decrease to 4.00 during July to December 1995.

The fall rate was examined on Five North Tower using the same format. During the first period of this study, January to June 1993, the fall rate was 4.08. From July 1993 to December 1993, the fall rate increased to 5.74. In

1994, from January to June the fall rate decreased to 4.70 but increased to 6.71 during July to December. During January to June in 1995, the fall rate was noted to increase to 6.84, and from July to December, the fall rate decreased to 5.82. (See Table 2)

Table 2: Fall Rates on Four Tower West and Five North Tower.

YEAR	Fall Rate Four Tower	YEAR	Fall Rate Five Tower
Jan-June 1993	2.09	Jan-June 1993	4.08
July-Dec 1993	4.67	July-Dec 1993	5.74
Jan-June 1994	6.08	Jan-June 1994	4.70
July-Dec 1994	7.68	July-Dec 1994	6.71
Jan-June 1995	4.99	Jan-June 1995	6.84
July-Dec 1995	4.00	July-Dec 1995	5.82

Comparison of Patient Falls to Hours Per Patient Day (HPPD)

An evaluation of the data and comparison of Hours Per Patient Day (HPPD) to patient falls was done to determine if there was any relationship between the hours per patient day to patient falls. At the gross data level, there appeared to be a relationship between patient falls and a declining HPPD on Four Tower West. When examining the time frame of January-June of 1993, the average HPPD was 6.15 with a fall rate of 2.09. In the next block of time, July to December of 1993 the average HPPD dropped by .18, and the fall rate

increased by 2.58. During January to June of 1994, the HPPD declined to 5.89, only a .08 decrease, but the fall rate again jumped upward to 6.08. During the time period of July to December 1994, the HPPD dropped to their lowest for the study period to 5.81, and again the fall rate rose, now to 7.68. The next period of the study, January to June 1995, saw an increase in the HPPD to 6.30, and the rate of falls dropped to 4.99. In July to December 1995, the fall rate dropped to 4.0 as the HPPD rose to 6.78. It was noted that at the end of the last period the HPPD were higher than during the first period of the study, but the fall rate remained above the fall rate of January to June 1993 by 1.91. (See Table 3)

Using the same process on Five North Tower, the first date period of January to June of 1993, the average HPPD was 6.73 and the fall rate is 4.08. During July to December 1993, the unit's HPPD dropped to 6.49, a 0.24 decline, and the fall rate rose to 5.74. From January to June 1994, the HPPD were 6.59, a tenth of a point more than that of the previous period, and the fall rate decreased by 1.04 points. In the next period, July to December 1994, the HPPD decreased by 0.5 of a point, to 6.09, and the fall rate rose to 6.71. In January to June of 1995, the HPPD rose to 6.49, but the fall rate rose to 6.84. In the last period of the

study, the HPPD rose to 7.10, and the fall rate dropped to 5.82. It was noted that during one period of this study, January to June of 1995, the fall rate did not drop when the HPPD increased. It was also noted that although during the final period of the study there was a decrease in the fall rate when the HPPD increased, the fall rate was higher than at the beginning of the study period, January to June of 1993. (See Table 3)

Table 3: Comparison of HPPD to Fall Rate on Four Tower West and Five North Tower.

DATE	HPPD Four Tower	Fall Rate Four Tower	DATE	HPPD Five Tower	Fall Rate Five Tower
Jan-June 1993	6.15	2.09	Jan-June 1993	6.73	4.08
July-Dec 1993	5.97	4.67	July-Dec 1993	6.49	5.74
Jan-June 1994	5.89	6.08	Jan-June 1994	6.59	4.70
July-Dec 1994	5.81	7.68	July-Dec 1994	6.09	6.71
Jan-June 1995	6.30	4.99	Jan-June 1995	6.49	6.84
July-Dec 1995	6.78	4.00	July-Dec 1995	7.10	5.82

Non-parametric correlation studies were done to determine if there were any statistically significant relationships between the HPPD and patient falls. Both Kendall's Tau and Spearman's Rho were used. All three years worth of data were used (n= 1095). On Four Tower West, Kendall's Tau correlation coefficient showed a -0.056, and Spearman's Rho correlation coefficient showed a -0.068

relationship of Falls to HPPD. A negative correlation existed when comparing hours per patient day to patient falls. Patient falls increased on Four Tower West as hours per patient day decreased. On Five North Tower, the relationship was not significant. (See table 4)

Table 4: Non Parametric Correlations of HPPD to Patient Falls on Four Tower West and Five North Tower.

Non Parametric Study		Four Tower West	# of Cases	Five North Tower	# of Cases
		Patient Falls	N	Patient Falls	N
Kendalls' Tau	HPPD	-0.056*	1095	0.034	1095
Spearman's Rho	HPPD	-0.068*	1095	0.042	1095

* Correlation is significant at the .05 level (two tailed) for HPPD to Patient Falls.

Comparison of Patient Falls to Overtime

Hours per patient day contained total hours that the staff members worked in a given twenty four hour period. That productive time, however had many components. The productive time in this study contained regular hours, overtime hours and floating hours. Regular hours were defined as the employee's regular scheduled shift. On Four Tower West, a regular scheduled shift comprised twelve hours. Overtime (O.T.) was defined as hours worked beyond the regularly scheduled shift in the same twenty four hour

period and greater than the scheduled work week. A regular work week for a "Twelve Hour" employee was thirty six hours, or three 12 hour shifts. On Five North Tower, however, the employee worked eight hours per regular shift and forty hours per week (5 eight hour shifts). Since the last four hours of the twelve hour shift employee was not considered "overtime" from a payroll practice, it was important that the study not consider it as overtime either. (See Table 5)

All hours worked on Four Tower West were not considered overtime until the employee worked either more then 12 hours in a day or more than forty hours in the work week. This was a standard payroll practice. On Five North Tower, all hours worked over eight hours in the work day or over forty hours in the work week were considered overtime. The work week was defined as seven days, from Sunday morning at 12:00 A.M. and ending Saturday night at 11:59 p.m.

An overtime rate, or average, was used by dividing the total hours of overtime in the six month period by 182.5 days to determine the average daily overtime hours. The same six month block of periods was used to look at the gross data. On Four Tower West, from January to June 1993, the overtime rate was 34.44 hours per day, while the fall rate was at 2.09. From July to December 1993, the fall rate increased to 4.67, and overtime increased to 39.37. By the January to June 1994 period, the rate had again increased to

41.00 hours per day, while the fall rate also increased to 6.08. For the July to December 1994 time frame, daily hours of overtime dropped to 38.87, but the fall rate increased again to 7.68. In 1995, the daily overtime hours were 40.02 and 39.75 for each six month period January to June and July to December, while the fall rate was at 4.99 and 4.00 respectively. (See Table 5)

Using the same technique, the hours of overtime compared to the fall rate on Five North Tower showed that from January to June in 1993, the overtime hours per patient day were 15.05, and the fall rate was at 4.08. From July through December in 1993, the overtime increased to 23.44, and the fall rated increased to 5.74. During 1994, the fall rate was 4.70, while the overtime was at 21.78 hours per day from January to June. The last six months of 1994 showed the fall rate at 6.71 and the hours of overtime at 18.44. In January 1995, the hours of overtime per day were 18.02 and the fall rate was at 6.84 for the first six month period. From July through December 1995, the fall rate was 5.82, and the overtime hours per day was 20.78.(see Table 5)

Table 5 Comparison of Fall Rate and Overtime on Four Tower West and Five North Tower.

DATE	Fall Rate Four Tower	Overtime Four Tower	DATE	Fall Rate Five Tower	Overtime Five Tower
Jan-June 1993	2.09	34.44	Jan-June 1993	4.08	15.05
July-Dec 1993	4.67	39.37	July-Dec 1993	5.74	23.44
Jan-June 1994	6.08	41.00	Jan-June 1994	4.70	21.78
July-Dec 1994	7.68	38.87	July-Dec 1994	6.71	18.44
Jan-June 1994	4.99	40.02	Jan-June 1995	6.84	18.02
July-Dec 1995	4.00	39.75	July-Dec 1995	5.82	20.78

Non parametric studies were done to again determine if there was a relationship between patient falls and the amount of overtime. On Four Tower West, Kendall's Tau B correlation coefficient showed overtime compared to falls at .045. Spearman's Rho showed overtime at .053. On Four Tower West, there was a near significant positive relationship with Kendall's Tau B and a significant positive relationship using Spearman's Rho study between overtime and patient falls. As overtime increased, patient falls also increased. Kendall's Tau b on Five North Tower demonstrated .001 correlation coefficient when falls were compared to overtime, and Spearman's rho demonstrated .002. There was no relationship between patient falls and overtime on Five North Tower. Correlation is significant at the .05 level.(See Table 6)

Table 6: Non Parametric Correlations of Overtime to Patient Falls on Four Tower West and Five North Tower.

Non Parametric Study		Four Tower West	# of Cases	Five North Tower	# of Cases
		Patient Falls	N	Patient Falls	N
Kendall's Tau	Overtime	.045	1095	.001	1095
Spearman's Rho	Overtime	.053*	1095	.002	

*Correlation is significant at the .05 level (two tailed) for Overtime to Patient falls.

Comparison of Patient Falls to Staff Floating to the Units

Floating hours were another component of the total productive hours that could comprise an employees work schedule. Floating of staff to another unit was looked at to see if there was any correlation to patient falls. Floating is defined when a staff member is hired to work in one unit, but due to a need for additional staff in another unit is moved to the unit in need. This can occur during the employee's regular scheduled shift or on overtime. Although some cross training was given, that is, training was given to staff members to enable them to better work in a different environment, this study looked to see if floating to another area then specifically hired and trained for, could relate to the number of patient falls.

All hours of floating time for this study comprised of

the amount of hours an employee worked in another area other than the one directly hired for. This data was obtained from the ANSOS system. The employee's hours worked were put into the system's data base, including what unit an employee worked in. All employees were listed in a "home" unit, that is the unit they were hired for. When an employee worked in a different unit, the hours were logged in the floated area and could be retrieved through a report writing program.

An average of the number of hours floated was initially used and divided by six month blocks of time in order to view the large amount of information. On Four Tower West during the first six month period of January to June 1993, 24.52 hours of floating time per day was seen, and the fall rate was 2.09. This decreased to 12.59, while the fall rate became 4.67 from July through December 1993. In 1994, from January to June, the fall rate was 6.08, and the floating hours per day were 23.30. From July through December, the fall rate increased to 7.68, while the floating hours were at 21.02. In January to June 1995, the fall rate was 4.99, while the float time was 23.18. In the last half of the year, July through December, the fall rate was 4.0, and the floating time was 18.81. (See Table 7)

On Five North Tower, during the same six month periods, the fall rate compared to the floating hours were: From January to June 1993, 4.08 to 32.75 and from July to

December was 5.74 and 13.69 respectfully. From January to June, in 1994, the fall rate was 4.70 as compared to the floating time of 9.95. The last six months of 1994 showed the fall rate on Five North Tower to be 6.71, and the float time was 13.69. In the fist period of 1995, January to June, the fall rate was 6.84, and the floating hours jumped to 39.86. From July through December of 1995, the fall rate was 5.82, and the floating hours stayed right at 36.75. (See Table 7)

Table 7. Fall Rate and Float Hours from January 1993 through December 1995 for Four Tower West and Five North Tower.

DATE	Fall Rate Four Tower	Float Hours Four Tower	DATE	Fall Rate Five Tower	Float Hours Five Tower
Jan-June 1993	2.09	24.52	Jan-June 1993	4.08	32.75
July-Dec 1993	4.67	13.59	July-Dec 1993	5.74	13.69
Jan-June 1994	6.08	23.30	Jan-June 1994	4.70	9.95
July-Dec 1994	7.68	21.02	July-Dec 1994	6.71	13.69
Jan-June 1994	4.99	23.18	Jan-June 1995	6.84	39.86
July-Dec 1995	4.00	18.81	July-Dec 1995	5.82	36.75

Using non parametric statistics to discover any relationship of fall rate to floating time, it was discovered that on Four Tower West, Kendall's Tau b showed a strong positive coefficient of .063, and Spearman's Rho showed .075 correlation coefficient. On Four Tower West a

positive correlation was seen between the number of floating hours and patient falls. The data suggests that as the amount of floating time increased, that is, as more nursing staff from other units comprised the daily staffing of Four Tower West, the fall rate also increased. On Five North Tower, Kendall's Tau and Spearman's Rho were low correlation, .026 and .031 respectively. There was no correlation to floating and patient falls on that unit. (See Table 8)

Table 8: Non Parametric Correlations of Floating Hours to Patient Falls on Four Tower West and Five North Tower.

Non Parametric Study		**Four Tower West**	**# of Cases**	**Five North Tower**	**# of Cases**
		Patient Falls	N	Patient Falls	N
Kendall's Tau	Float hrs	.063*	1095	.026	1095
Spearman's Rho	Float hrs.	.075*	1095	.031	1095

*Correlation is significant at the .05 level (two tailed) for Overtime to Patient falls.

Comparison of Patient Falls to Licensed and Unlicensed Staff

The nursing staff caring for patients on the units during this study were comprised of both licensed and unlicensed staff. A licensed staff member was defined as either a registered nurse or a licensed vocational nurse. Both of these kinds of nurses carried a license from the State of California that allowed them to practice as a

nursing professional. The non licensed staff members were either a nursing assistant or a ward secretary. The mix of these staff members was believed to be a factor in patient falls. For the purposes of this study, the hours of both the licensed and unlicensed staff was divided into six month blocks of time. An average number of hours of licensed and unlicensed staff was obtained by taking the total number of hours in each six month block of time and dividing by 182.5 days (six months).

In looking at the data, the following was noted. From January to June 1993, on Four Tower West, there were 84.51 hours of licensed staff and 69.5 hours of unlicensed staff. The fall rate was at 2.09. From July to December 1993, the Fall rate increased to 4.67, and the average licensed hours was 80.71, and the unlicensed hours was 47.8. During the next year, from January to June 1994, the fall rate was 6.08, the average licensed hours was 78.88, and unlicensed hours were 39.07. The last half of the year, July to December 1994, the amount of licensed staff per day was 76.58 and the unlicensed staff was 65.58. The fall rate was 7.68. From January to June 1995, the hours of licensed staff increased to 96.38, and the unlicensed staff also increased to 65.58. The fall rate dropped to 4.99. In the last period, July to December 1995, the licensed hours was

97.45, and the unlicensed hours were 73.25. The fall rate fell again to 4.0. (See table 9)

Using the same technique for Five North Tower, the average licensed hours per day was 100.52, and unlicensed was 60.77. The fall rate was 4.08 during January to June 1993. From July to December 1993, the licensed staff became 101.01, and the unlicensed hours fell to 43.47. The fall rate rose to 5.74. In the January to June 1994 period, the licensed staff average hours per day was 102.90 and the unlicensed staff was 45.80 while the fall rate was 4.70. From July to December 1994, the fall rate increased to 6.71, while the licensed staff hours were 91.06. The unlicensed staff fell to 31.13. In the first six month period of 1995, January to June, the fall rate increased to 6.84 and the average hours of licensed staff was 114.79. The unlicensed staff was 59.53. From July to December 1995, the hours of licensed staff were 101.02, and the unlicensed staff was 79.64 hours. The fall rate was 7.10. (See Table 9)

Table 9. Fall Rate to Licensed and Unlicensed Staff on Four Tower West and Five North Tower.

DATE	Fall Rate Four Tower	Lic-ensed Staff Four Tower	Unlic-ensed staff Four Tower	DATE	Fall Rate Five Tower	Lic-ensed Staff Five Tower	Unlic-ensed Staff Five Tower
Jan-June 1993	2.09	84.51	69.50	Jan-June 1993	4.08	100.52	60.77
July-Dec 1993	4.67	80.71	47.80	July-Dec 1993	5.74	101.01	43.47
Jan-June 1994	6.08	78.88	39.07	Jan-June 1994	4.70	102.90	45.80
July-Dec 1994	7.68	76.58	36.30	July-Dec 1994	6.71	91.06	31.13
Jan-June 1995	4.99	96.38	65.58	Jan-June 1995	6.84	114.79	59.53
July-Dec 1995	4.0	97.45	73.25	July-Dec 1995	5.82	101.02	79.64

Non parametric statistics were used to determine if there was any rank correlation between the mix of the staffing, licensed or unlicensed, to patient falls. On Four Tower West, Kendall's Tau demonstrated a low correlation between both licensed and unlicensed staff when compared to falls, .029 and -.020 respectfully. Spearman's Rho also showed low results of .034 for licensed and -.025 for unlicensed. On Five North Tower, however, the presence of licensed staff showed a .065, and unlicensed staff was .049 with Kendall's Tau non parametric statistics. Spearman's Rho showed .077 for Licensed staff and .058 for unlicensed staff. On Five Tower North, there was a strong positive

correlation for the number of licensed staff with patient falls. This finding suggests that there was a strong indication that the ratio of licensed staff related to an increase in patient falls. (See Table 10)

Table 10. Non Parametric Study of Licensed and Unlicensed Staff on Four Tower West and Five North Tower Compared to the Number of Patient Falls.

Non Parametric Study		**Four Tower West**	**# of Cases**	**Five North Tower**	**# of Cases**
		Patient Falls	N	Patient Falls	N
Kendall's Tau	Licensed	.029	1095	.065*	1095
Kendall's Tau	Unlicensed	-.020	1095	.049	1095
Spearman's Rho	Licensed	.034	1095	.077*	1095
Spearman's Rho	Unlicensed	-.025	1095	.058	1095

*Correlation is significant at the .05 level (two tailed) for Licensed staff and Unlicensed staff to Patient falls.

Comparison of Hours of Overtime to Floating Hours

Both overtime hours and floating hours were compared to the fall rate. It was important to also look at how much of the floating hours were also overtime hours. It was already noted that there was a positive correlation between patient falls and overtime and floating hours on Four Tower West. Five North Tower, however, did not show the same kind of correlation. Five North Tower did show there was a relationship between licensed staff and patient falls. Non parametric studies were used to evaluate the composition of

supplemental staff to see if float hours were also overtime hours. On Four Tower West, it was evident that there was a very strong correlation between float hours and overtime hours. Kendall's Tau B showed a .135 positive correlation of overtime hours with float hours, and Spearman's Rho showed .187 positive coefficient. (Correlation is significant at the .01 level) This finding suggests that there was a significantly high proportion of float hours which were also comprised of overtime hours. This indicates that staff floating from other areas to cover a shortage of staff on Four Tower West were also working overtime. On Five North Tower, it was also evident that the floating hours had a high proportion of overtime. Kendall's Tau B showed a .205 positive correlation, and Spearman's Rho was .273 positive. (See Table 11)

Table 11: Non Parametric Study of Floating Time and Overtime on Four Tower West and Five North Tower.

Non Parametric Study		**Four Tower West**	**# of Cases**	**Five North Tower**	**# of Cases**
		Overtime	N	Overtime	N
Kendall's Tau	Floating Time	.135**	1095	.205**	1095
Spearman's Rho	Floating Time	.187**	1095	.273**	1095

**Correlation is significant at the .01 level.

Chapter Five - Conclusions

Conclusions and Implications

The purpose of the study was to answer three questions. 1) Is there a relationship between the number of patient falls and the available staff assigned to care for the patients? 2) Is there a relationship in the number of patient falls and the mix of staff assigned to care for the patients? 3) Is there a point at which further reductions in staff to care for the patients will increase the risk of patient falls?

In analyzing three years worth of data on two separate nursing units, it is evident that answers to these questions were found. Four Tower West, one of the nursing units in the study, had a nursing staff that worked primarily twelve hour shifts and cared for patients that were generally surgical patients. On that unit, non parametric studies indicated that a decease in the amount of nursing staff (hours per patient day) correlated with an increase in patient falls. Non parametric studies also indicated that as the use of overtime increased, patient falls also increased. Finally, non parametric studies also showed a correlation to patient falls and the amount of staff floated from other areas. Literature supported that an increase in patient falls occurred in units where there was a shortage

of staff. There was no literature found to either support or deny that staff members working on overtime impacted patient falls. Literature did support, however, that untrained staff can increase the patient fall rate. Further studies of the floating staff hours demonstrated that a significant portion of float hours (at the .01 level of significance) were also overtime hours. It demonstrated that staff from other areas were also working on overtime, so that not only was the staff working on Four Tower West floated from another area, they also were working on overtime hours. Further research on the impact of overtime, particularly a possible "fatigue" factor should be explored.

There did not seem to be a relationship between the mix of staff, that is, the number of licensed to unlicensed staff members and patient falls on Four Tower West. It appeared that the mix of staff was appropriate on that unit. The results of the data did indicate that patient falls increased on Four Tower West when there was less staff available, the staff that was available had a high degree of overtime workers, or there was a high percentage of staff from other nursing units were working on that unit.

Five North Tower was a nursing unit with a different mix of patients, primarily medical. The nursing staff also worked eight hour shifts. Non parametric studies demonstrated that the hours per patient day, that is, the

amount of staff available, was sufficient and did not impact the number of patient falls. In comparison to Four Tower West, Five North Tower's hours were higher. Since there was no positive correlation it could be suggested that there was not "too much staff" available in relationship to the number of patients.

Overtime hours, a factor on Four Tower West, were significantly less on Five North Tower and consequently did not impact patient falls on that unit. Additionally, the amount of staff floating to Five North Tower was significantly less than on Four Tower West, and therefore, was not a factor in patient falls. When the float hours were examined further in the study, it was noted, as on Four Tower West, that a significantly high portion of the staff floated to Five North Tower were also working on overtime. (significant at the .01 level) Again, further studies should be done relating to overtime worked and the impact on patient falls.

The mix of staff on Five North Tower was a factor in the amount of patient falls on that unit. There was a significant correlation (significant at the .05 level) in patient falls with the amount of licensed staff. The correlation is positive, so the higher the mix of licensed to unlicensed staff the higher the fall rate. The role definition of licensed and unlicensed staff was reviewed.

The licensed staff primarily had oversight of the patient care, such as assessing, planning and implementing care. The unlicensed staff primarily were task oriented with job duties such as bathing, turning the patient, and answering call lights. When the roles of licensed and unlicensed staff are examined in light of the data, it may indicate that having a higher percentage of licensed to unlicensed staff can increase patient falls. Although literature did support that the amount of available staff can affect patient falls, there was no research found that revealed what kind of staff needed to be available. Clearly there is a need for further research into the mix of staff assigned to patient care.

The data was reviewed in both nursing units to determine if there was a point at which further reductions in staff would increase the risk of patient falls. On Five North Tower, since low staffing was not a factor in patient falls, it could indicate that the hours per patient day (HPPD) on that unit were sufficient and was not a factor in patient falls. Four Tower West clearly showed that the HPPD was a factor in patient falls. However, it is unclear at which point patient falls occurred because of the staffing, since falls also occurred because of high overtime hours and high floating hours.

Limitations of the Study

This study was conducted using data collected at one hospital which may not have the same implications to other hospitals. Hospitals of similar size and patient population should conduct their own studies as each institution has its unique qualities.

At the time this study was conducted, a formal fall prevention program was not in place on either unit. It was assumed in this study that the presence of a formal fall prevention program would not have effected the outcome of the study. Literature supports the need for adequate staffing to implement and monitor fall preventions programs. However, it is important for those facilities who do have a such a program to conduct their own studies of the effects of staffing patterns before changing any program based on the outcome of this research.

The degree of illness, or acuity of the patient, was not part of this study due to the lack of available data. Since patients are entering the hospitals in more acute conditions then ever before, it is important that further research on how staffing affect patient falls should include this factor.

Recommendations

There are three main factors identified in this study that affected the fall rate for the two nursing units: 1) The number of staff on the floor, 2) The mix of the staff, i.e. licensed versus unlicensed, and floating staff versus regularly scheduled staff, and 3) Staff working overtime. As hospitals face a continued decline in the amount of reimbursement for patient care, it is important that the temptation to cut costs through cutting staff be avoided. As evidenced on Four Tower West, hours per patient day need to be sufficient to care for the needs of the patient. The increase in costs associated with patient falls, not to mention the ethical issues of not providing adequate protection to patients to prevent falls, can also increase costs through law suits. Just as important as the amount of staff is the mix of staff. Five North Tower demonstrated that not enough staff actually performing the basic patient care needs, such as answering call lights, can also cause an increase in patient falls. Further investigation into the "right mix" of licensed to unlicensed is recommended.

The right mix of care givers also extends to the amount of floated personnel to the unit. Even cross-training staff to other units does not provide sufficient education in caring for patients. The content of the training may need

to be re-evaluated to ensure that the appropriate information is being shared with a frequency to keep competency levels high. Limiting the amount of floating would be the best solution, and this could occur through adequate hiring of unit based staff.

The impact of overtime on patient falls was significant on Four Tower West. This speaks to the numbers of unit based staff being so low that any change in the census of the floor requiring more staff is met most often though overtime. Not only does the hospital have an increase cost in manpower due to overtime, the increase in patient falls also increases costs. Again, hiring sufficient unit based staff would limit the amount of overtime required to cover census changes, staff sick calls, and vacations.

Finally, the different shifts worked on the units in this study should be evaluated to determine if working twelve hour shifts contributes in any way to the increased use of overtime or floating. There appeared to be sufficient quantity of staff on Five North Tower and low enough overtime and floating staff to not impact falls significantly.

APPENDIX A: Spread Sheet Data Collection Form for January 1, 1993 through January 31, 1993 for Five North Tower

DATE	DAYS	FALLS	NAPROD	LVNPROD	RNPROD	WCPROD	OVERTIME	SUPP	TOTLIC	TOTUNLI	TOTPROD	HPPD	FLOOR
01-Jan-93	16.00	0.00	72.00	8.00	56.00	8.00	0.00	40.00	64.00	80.00	144.00	9.00	5.00
02-Jan-93	17.00	0.00	56.00	0.00	74.00	8.00	4.00	32.00	74.00	64.00	138.00	8.12	5.00
03-Jan-93	23.00	0.00	56.00	0.00	72.00	16.00	4.00	40.00	72.00	72.00	144.00	6.26	5.00
04-Jan-93	19.00	0.00	44.00	8.00	72.00	16.00	0.00	28.00	80.00	60.00	140.00	7.37	5.00
05-Jan-93	19.00	0.00	44.00	8.00	72.00	16.00	0.00	28.00	80.00	60.00	140.00	7.37	5.00
06-Jan-93	20.00	0.00	48.00	8.00	72.00	20.00	0.00	8.00	80.00	68.00	148.00	7.40	5.00
07-Jan-93	25.00	1.00	56.00	0.00	88.00	16.00	0.00	16.00	88.00	72.00	160.00	6.40	5.00
08-Jan-93	23.00	0.00	48.00	8.00	88.00	32.00	8.00	40.00	96.00	80.00	176.00	7.65	5.00
09-Jan-93	24.00	0.00	63.00	8.00	72.00	16.00	80.00	63.00	80.00	79.00	159.00	6.63	5.00
10-Jan-93	25.00	0.00	68.00	8.00	72.00	16.00	4.00	48.00	80.00	84.00	164.00	6.56	5.00
11-Jan-93	27.00	0.00	56.00	0.00	96.00	24.00	0.00	52.00	96.00	80.00	176.00	6.52	5.00
12-Jan-93	28.00	1.00	60.00	8.00	104.00	8.00	4.00	64.00	112.00	68.00	180.00	6.43	5.00
13-Jan-93	31.00	1.00	60.00	8.00	96.00	24.00	12.00	36.00	104.00	84.00	188.00	6.06	5.00
14-Jan-93	28.00	0.00	72.00	8.00	88.00	24.00	0.00	72.00	96.00	96.00	192.00	6.86	5.00
15-Jan-93	24.00	0.00	56.00	0.00	96.00	24.00	8.00	24.00	96.00	80.00	176.00	7.33	5.00
16-Jan-93	23.00	1.00	44.00	3.00	80.00	16.00	68.00	39.00	83.00	60.00	143.00	6.22	5.00
17-Jan-93	26.00	0.00	64.00	0.00	88.00	16.00	4.00	48.00	88.00	80.00	168.00	6.46	5.00
18-Jan-93	25.00	0.00	68.00	8.00	80.00	16.00	4.00	40.00	88.00	84.00	172.00	6.88	5.00
19-Jan-93	24.00	1.00	56.00	8.00	88.00	24.00	0.00	48.00	96.00	80.00	176.00	7.33	5.00
20-Jan-93	25.00	0.00	56.00	8.00	72.00	24.00	0.00	40.00	80.00	80.00	160.00	6.40	5.00
21-Jan-93	26.00	0.00	64.00	0.00	80.00	16.00	0.00	40.00	80.00	80.00	160.00	6.15	5.00
22-Jan-93	25.00	0.00	64.00	8.00	80.00	4.00	0.00	48.00	88.00	68.00	156.00	6.24	5.00
23-Jan-93	23.00	0.00	64.00	8.00	80.00	16.00	80.00	72.00	88.00	80.00	168.00	7.30	5.00
24-Jan-93	23.00	0.00	64.00	8.00	72.00	8.00	8.00	48.00	80.00	72.00	152.00	6.61	5.00
25-Jan-93	20.00	0.00	48.00	0.00	88.00	16.00	4.00	64.00	88.00	64.00	152.00	7.60	5.00
26-Jan-93	23.00	0.00	54.00	8.00	72.00	16.00	0.00	24.00	80.00	70.00	150.00	6.52	5.00
27-Jan-93	26.00	0.00	56.00	8.00	88.00	12.00	8.00	32.00	96.00	68.00	164.00	6.31	5.00
28-Jan-93	24.00	0.00	56.00	8.00	88.00	24.00	4.00	40.00	96.00	80.00	176.00	7.33	5.00
29-Jan-93	27.00	0.00	48.00	8.00	80.00	32.00	0.00	24.00	88.00	80.00	168.00	6.22	5.00
30-Jan-93	29.00	0.00	64.00	0.00	96.00	16.00	86.50	72.00	96.00	80.00	176.00	6.07	5.00

APPENDIX B: Overview of Collected Data in Six Month Blocks for Four Tower West and Five North Tower

Year-4 Tower	Falls 4	HPPD	OT	SUPP	Licensed	Unlicensed	PT DAYS
Jan-July 93	2.09	6.15	34.44	24.52	84.51	69.50	4793.00
July-Dec 93	4.67	5.97	39.37	13.59	80.71	47.80	4492.00
Jan-July 94	6.08	5.89	41.00	23.30	78.88	39.07	4771.00
July-Dec 94	7.68	5.81	38.87	21.02	76.58	36.30	3904.00
Jan-July 95	4.99	6.30	40.02	23.18	96.38	65.58	5011.00
July-Dec 95	4.00	6.78	39.75	18.81	97.45	73.25	5001.00
				Total	514.51	331.51	
Year-5 Tower	Falls 5	HPPD	OT	SUPP	Licensed	Unlicensed	PT DAYS
Jan-July 93	4.08	6.73	13.84	32.75	100.52	60.77	4167.00
July-Dec 93	5.74	6.49	23.44	13.69	101.01	43.47	3661.00
Jan-July 94	4.70	6.59	21.78	9.95	102.90	45.80	3404.00
July-Dec 94	6.71	6.09	18.44	13.69	91.06	31.13	3428.00
Jan-July 95	6.84	6.49	18.02	39.86	114.79	59.53	4534.00
July-Dec 95	5.82	7.10	20.78	36.75	101.02	79.64	4471.00
				Total	611.30	320.35	

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